CLAIMS

What is claimed as new and desired to be protected by Letters Patent of the United States is:

1. An imaging pixel comprising:

A photosensor for connecting photo energy into electrical charges;

an output transistor for ~~connecting~~ electrical charges produced by said photo sensor into an electrical signal; and

a capacitor for storing said electrical charges, wherein the size of said capacitor is associated with the color expanse characteristics of said imaging pixel.

2. A photosensor as in claim 1, wherein the color of the

photosensor is red, and the storage capacity of the capacitor is between about 0 and about 20 femtofarads.

3. A photosensor as in claim 1, wherein the color of the

photosensor is green, and the storage capacity of the capacitor is between about 2 and about 20 femtofarads.

4. A photosensor as in claim 1, wherein the color of the

photosensor is blue, and the storage capacity of the capacitor is between about 3 and about 20 femtofarads.

5. The photosensor according to claim 1, wherein said storage Capacitor is a flat plate capacitor.

6. The photosensor according to claim 5, wherein said storage capacitor is a flat plate capacitor including a first electrode, a second electrode and a dielectric layer between said first and second electrodes.

7. The photosensor according to claim 6, further comprising a transistor for transferring charge between said photosensor and output transistor.

8. The photosensor according to claim 6, wherein said second electrode of said storage capacitor is connected to a gate of said transfer transistor.

9. The photosensor according to claim 1, wherein said storage capacitor is connected to said charge collection region by a metal contact.

10. An imager pixel comprising:

a photosensor formed in a substrate;

a charge collection region formed in said substrate for collecting charge from said photosensor;

a charge storage capacitor electrically connected to said charge collector region, a storage capacity of the capacitor being based on the color of the photosensor.

11. The photosensor according to claim 11, wherein said charge storage capacitor is formed fully over said field oxide region.

12. The photosensor according to claim 11, wherein said charge storage capacitor is formed fully over said active area.

13. The photosensor according to claim 11, wherein said charge storage capacitor is formed partially over said field oxide region.

14. The photosensor according to claim 11, wherein said charge storage capacitor is formed partially over said active area.

15. The photosensor according to claim 11, wherein said storage capacitor is a flat plate capacitor including a first electrode, a second electrode and a insulating layer between said first and second electrodes.

16. The photosensor according to claim 16, wherein said transferred charge region is connected to said first electrode by an electrical contact.

17. The photosensor according to claim 16, wherein said second electrode is further connected to a gate of a transfer transistor.

18. The photosensor according to claim 11, further comprising a

source follower transistor for outputting charge accumulated in said transferred charge region which has been transferred to said transferred charge region, wherein the gate of said source follower transistor is formed adjacent said transferred charge region.

19. The photosensor according to claim 20, wherein said second electrode is further connected to a gate of said source follower transistor.

20. The photosensor according to claim 11, wherein said photosensor is used in a CMOS imager.

21. A photosensor for use in an imaging device, said photosensor comprising:

a field oxide region formed in a substrate;

a doped layer of a first conductivity type formed in said substrate and adjacent said field oxide region;

a charge collection region formed in said doped layer;

a first doped region of a second conductivity type formed in said doped layer adjacent said charge collection region; and

a first storage capacitor formed over said substrate adjacent said first doped region and connected to said first doped region to store charge collected in said charge collection region, said storage capacitor being formed at least partially over at least one of said field oxide region and an active area of said photosensor;

a transferred charge region for receiving charge from said charge collection region; and

a second storage capacitor connected to said transferred charge region, a storage capacity of the capacitors being selected based on the color

of the photosensor.

22. The photosensor according to claim 23, wherein said second storage capacitor is formed at least partially over at least one of said field oxide region and said active area.

23. The photosensor according to claim 23, wherein said first and second capacitors are formed entirely over said field oxide region.

24. The photosensor according to claim 23, wherein said first and second capacitors are formed entirely over said active area.

25. The photosensor according to claim 23, wherein the first conductivity type is p-type, and the second conductivity type is n-type.

26. The photosensor according to claim 23, further comprising a source follower transistor for outputting charge accumulated in said transferred charge region which has been transferred to said transferred charge region, wherein the gate of said source follower transistor is formed adjacent said transferred charge region.

27. The photosensor according to claim 23, wherein said photosensor is used in a CMOS imager.

28. A CMOS imager system comprising:

(i) a processor; and

(ii) a CMOS imaging device coupled to said processor, said CMOS imaging device comprising:

a doped layer of a first conductivity type formed in a substrate and adjacent a field oxide region;

a charge collection region formed in said doped layer;

a first doped region of a second conductivity type formed in said doped layer adjacent said charge collection region; and

a charge storage capacitor formed entirely over said field oxide region, a storage capacity of the capacitor being selected based on the color of the photosensor.

29. The system according to claim 30, further comprising a second doped region of a second conductivity formed in said doped layer adjacent a portion of said charge collection region and opposite said first doped region.

30. The system according to claim 32, further comprising a transfer transistor for transferring charge accumulated in said second doped region to a third doped region of said second conductivity type formed in said doped layer of said first conductivity type, wherein the gate of said transfer transistor is formed adjacent said second doped region.

31. The system according to claim 33, further comprising a source follower transistor for outputting charge accumulated in said third doped region which has been transferred to said third doped region, wherein the gate of said source follower transistor is formed adjacent said third doped region.

32. A method of forming a CMOS imager having improved charge storage comprising the steps of:

providing a semiconductor substrate having a doped layer of a first conductivity type;

forming a first doped region of a second conductivity type in said doped layer, said first doped region being adjacent a field oxide region;

forming a charge storage capacitor overlying entirely over at least one of said field oxide region and an active area of said CMOS imager; and

forming a contact between said first doped region and said charge storage capacitor, a storage capacity of the capacitor being selected based on the color of the photosensor.

33. The method according to claim 35, wherein said charge storage capacitor is formed entirely over said field oxide region.

34. The method according to claim 35, wherein said charge storage capacitor is formed entirely over said active area.

35. The method according to claim 35, wherein said charge storage capacitor is formed by:

forming a first conductive layer over said substrate including said field oxide region;

forming a dielectric layer over said first conductive layer; and

forming a second conductive layer over said dielectric layer.

36. The method according to claim 38, wherein said first electrode is a titanium nitride layer, a doped polysilicon layer or a hemispherical grained polysilicon layer.

37. The method according to claim 38, wherein said second electrode is a platinum metal layer, a tungsten metal layer, a titanium nitride layer or a doped polysilicon layer.

38. The method according to claim 38, further comprising:

forming a second doped region of said second conductivity type in the doped layer spaced from said first doped region to transfer charge from a charge collection area;

forming a third doped region of said second conductivity type in the doped layer spaced from said second doped region wherein said third doped region effectuates the transfer of charge to a readout circuit; and

forming a fourth doped region of said second conductivity type in the doped layer spaced from said third doped region wherein said fourth doped region is a drain for a reset transistor for said CMOS imager.

39. The method according to claim 42, wherein the first conductivity type is p-type, and the second conductivity type is n-type.

40. The method according to claim 42, further comprising forming a photogate over said doped layer between said first and second doped regions.

41. A method of forming a CMOS imager having improved charge storage comprising the steps of:

providing a semiconductor substrate having a doped layer of a first conductivity type;

forming a field oxide region within said semiconductor substrate;

forming a first conductive layer over said field oxide region and said substrate;

forming an insulating layer over said first conductive layer;

forming a second conductive layer over said insulating layer;

patterning said first conductive layer, said insulating layer and said second conductive layer to form a storage capacitor and an electrical element of said CMOS imager, wherein said storage capacitor is formed entirely over and in contact with said field oxide region, a storage capacity of the capacitor being selected based on the color of the photosensor.

42. The method according to claim 44, further comprising:

forming a first doped region of a second conductivity type in said doped layer and adjacent said field oxide region;

forming a second doped region of said second conductivity type in said doped layer spaced from said first doped region;

forming a third doped region of said second conductivity type in said doped layer spaced from said second doped region and adjacent said electrical element; and

forming a fourth doped region of said second conductivity type in said doped layer spaced from said third doped region.

43. The method according to claim 45, wherein the first conductivity type is p-type, and the second conductivity type is n-type.

44. The method according to claim 46, wherein said first doped region, said second doped region, said third doped region and

said fourth doped region are doped at a dopant concentration of from about $1x10^{15}$ ions/cm^2 to about $1x10^{16}$ ions/cm^2.

45. The method according to claim 47, wherein said electrical element is a transfer gate.

46. The method according to claim 45, further comprising forming a reset transistor and a source follower transistor.